MESOSCALE DISTRIBUTION OF THECOSOMATA (GASTROPODA) IN THE BRAZIL-MALVINAS CONFLUENCE COMPARED WITH SIMULTANEOUS SATELLITE IMAGES OF SURFACE TEMPERATURE

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ABSTRACT

The mesoscale distribution of Thecosomata in the Brazil-Malvinas Confluence is analyzed together with satellite images of surface temperature. The analysis shows the relationship between the assemblages distribution and the eddies dynamics. This relationship is used to determine the potencial geographical ranges of the assemblages in the area (south of 35° 30'S for cold-water species; north of 49° S for warm-water species), which are compared with the available data.

KEYWORDS. Distribution; geographical ranges; remote sensing; Thecosomata.

INTRODUCTION

The Brazil-Malvinas (Falkland) confluence is a very dynamic area where two distinctive faunas of Thecosomata contact to each other. One assemblage is associated with the cold, subantarctic Malvinas current, and the other, with the warm, subtropical Brazil current. These assemblages have no species in common.

The sharp environmental gradient at the Subtropical Front (up to 1°C/250m; GARZOLI & GARRAFFO, 1989) would seem to be a well-delimited natural boundary between their geographical ranges for the megascale analysis, but a more detailed environmental information is needed for shorter scales.

This paper analyzes the relationship between the distribution of the Thecosomata and the surface dynamics of the Brazil-Malvinas Confluence, in order to determine the geographical mesoscale ranges of the different faunistical assemblages.

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MATERIAL AND METHODS

Samples were collected in shallow-water (up to 5m) at night-time during Cruise 75-5 of the R/V Hero from September 10 to October 6, 1975 (fig. 1). The samples belong to the malacological collections of Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (Buenos Aires, Argentina). Satellite images obtained simultaneously with the cruise are provided by LEGECKIS & GORDON (1982).

RESULTS AND DISCUSSION

Many distributional data from the Confluence area cannot be univocally interpreted without complete information about the hidrological pattern. Stations 1 to 7 along the south-north leg of the Cruise 75-5 (tab. I) show the following sequence of faunas: subantarctic, subtropical, both types and finally, subtropical. Punctual environmental data at those stations do not provide enough information to decide on the correct interpretation among all the possible ones.

Table 1. Sampling data of Thecosomata collected during the Cruise 75-5 of the R/V Hero in the Brazil-Malvinas Confluence area from September 10 to October 6, 1975. (X = records of the species).

	STATION																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Date	IX/13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	X/2	3
Surface tempertature (ºC)	6.1	12.2	17.1	15.8	15.0	18.3	18.3	21.1	18.8	18.8	17.0	15.0	15.0	13.5	10.0	8.5	—	5.0	4.2	5.5
Cold-water species																				
Limacinidae																				
Limacina helicina (Phipps, 1774)	X	X		X	X									X	X	X	X		X	X
L. retroversa (Fleming, 1823)	X			X	X	X												X		
Warm-water species																				
Limacinidae																				
Limacina inflata (Orbigny, 1836)			X	X	X	X	X	X		X	X	X	X	X	X					
L. trochiformis (Orbigny, 1836)			X				X	X	X	X										
L. bulimoides (Orbigny, 1836)			X		X		X		X	X										
Cavoliniidae																				
Styliola subula (Q. & Gaim., 1827)			X					X			X									
Cavolinia sp.			X	X			X				X									
C. longirostris (Blainville, 1821)								X												
Diacria trispinosa (Blainville, 1821)					X	X	X													
Clio p. lanceolata (Leus., 1813)			X																	
C. cuspidata (Bosc, 1802)													X		X					
Cuvierina columnella (Rang, 1827)							X													
Creseis acicula (Rang, 1828)								X												
C. virgula conica Eschscholtz, 1829										X										

According to the instantaneous hydrological pattern (as shown by the satellite images fig. 1), Station 1 was in the core of the Malvinas Current; Station 2 was in subantarctic waters south of the subtropical front; Station 3 was north of the subtropical front; and Stations 4 and 5 were in the neighbourhood of a large cold-core eddy 500km long situated within the area 36-40° S and 49-53° W. So, the mixture of faunal assemblages was observed as associated with a complex pattern of meanders and eddies.

Since the entire sampled area was not completelly covered by the images, it is again difficult to arrive at unquestionable conclusions for stations situated eastward Station 5. Station 6 was probably near another cold-core eddy, but the situation of Stations 14 and 15 into the hydrological scheme is not clear. Surface temperature at Station 15 was closer to subantarctic than subtropical waters (a cold-core eddy?), and here is not clear the position of the subtropical front.

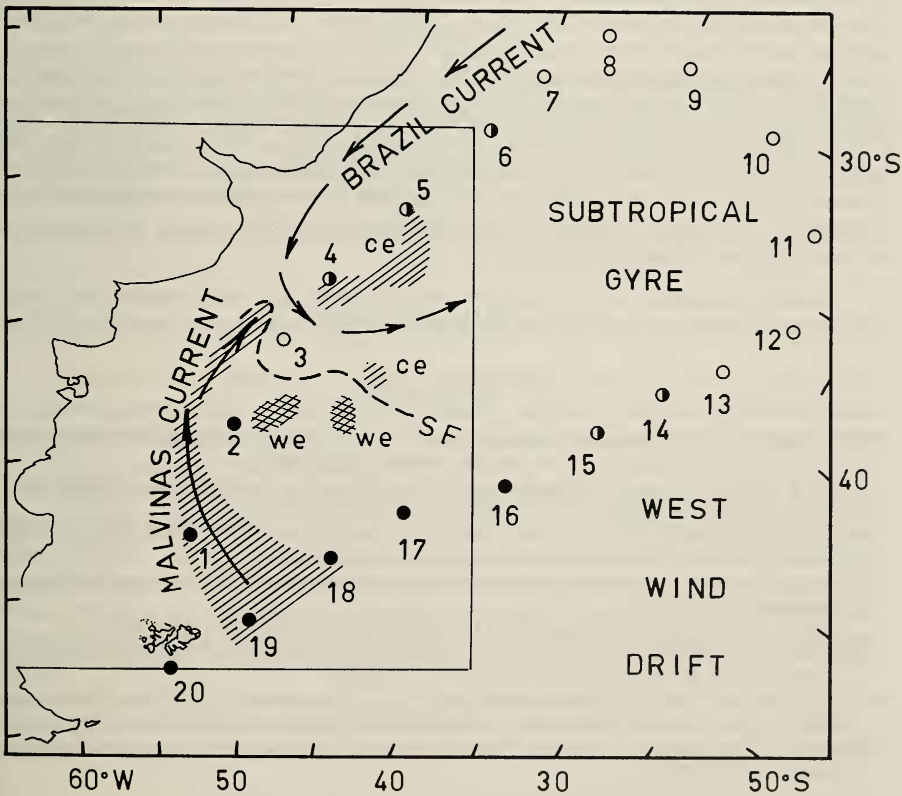

Fig. 1. Oceanographic stations of the Cruise 75-5 of the R/V Hero from September 10 to October 6, 1975, and hydrological surface pattern observed on September 15, 1975. The frame indicates the area covered by satellite images. (See the increment of valuable information, in comparison with the noncovered area). ce, cold-core eddies; SF, Subtropical Front; we, warm-core eddies. Black circles, cold-water assemblage; black and white circles, both cold- and warm-water assemblages; white circles, warm-water assemblage. The numbers indicate the general stations.

In general, the simultaneous mesoscale analysis of the hydrological pattern and the sampling data of Thecosomata shows that the geographical ranges of the species are directly related with the eddies dynamics. This relationship can be used to predict the further expected latitudinal boundaries of the warm and cold water assemblages of species.

Some information about the eddies formation processes is available for the area. Warm- and cold-core eddies originate at different rates. Cold-core eddies show no apparent periodicity (GARZOLI & GARRAFFO, 1989) and they were detected up to aproximately 35° 30'S (LEGECKIS & GORDON, 1982: fig. 5), which might be the northernmost surface boundary for subantarctic species. Up to date, the most septentrional records of *Limacina retroversa* and *L. helicina* were located at 33° 12'S (DADON, 1989).

Warm-core eddies originate in the area at a rate of six or more per year and age up to 2.5 months; they spawned at the Confluence drift to the southeast, cooling and mixing into the subantarctic water (GORDON, 1988; 1989). According to this, warm-water species should expect to be found regularly south of the subtropical front, over the route of the warm-core eddies, which extends as south as 49° S (LEGECKIS & GORDON, 1982: fig. 15). The southernmost records for warm-water species in the area are far from this latitude: 43° 32'S for *Limacina inflata*, (MAGALDI, 1974); 42° 06'S for *Creseis acicula*, (BOLTOVSKOY, 1975); 43° 20'S for *Hyalocylis striata*, (MASSY, 1932). The Thecosomata of the Confluence area have seldom been studied and additional data are necessary to determine whether the potential range (extending up to 49° S) is actually occupied by the warm-water species.

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